ADDING AND SUBTRACTING FRACTIONS 8

Name: Key Date: Period:

SECTION 8.4 ADDITION AND SUBTRACTION OF FRACTIONS

VOCABULARY

DEFINITION	EXAMPLE
Common denominator: a denominator shared by several fractions	$\frac{5}{8}, \frac{4}{8}, \frac{1}{8}$ etc. have 8 as a common denominator
Least common denominator: The least common denominator (LCD) of $\frac{p}{n}$ and $\frac{k}{m}$ is the LCM of n and m.	LCD of $\frac{1}{5}$ and $\frac{1}{3}$ is (15) $= \frac{3}{15}$ $= \frac{5}{15}$

Big Idea: How do we add and subtract fractions?

PROBLEM 1

Compute the sum of $\frac{3}{8}$ and $\frac{2}{8}$. Explain how to obtain the answer.

add the numerators.

$\frac{3}{8} + \frac{2}{8} = \left(\frac{1}{8} + \frac{1}{8} + \frac{1}{8}\right) + \left(\frac{1}{8} + \frac{1}{8}\right) = 5\left(\frac{1}{8}\right)$ or $\boxed{\frac{5}{8}}$

Write a rule that can be used for adding the fractions $\frac{a}{n}$ and $\frac{b}{n}$ (addition of fractions with like denominators).

add the numerators to add fractions with a common denominator:

$$\frac{a}{n} + \frac{b}{n} = \frac{a+b}{n}$$

Compute the sum $2 + \frac{3}{5}$.

$\frac{5}{5} + \frac{5}{5} + \frac{3}{5} = \frac{13}{5}$ (improper) or $2\frac{3}{5}$ (mixed)

PROBLEM 2

Compute the difference $\frac{7}{9} - \frac{4}{9}$ and explain how to obtain the answer.

$\frac{7}{9} - \frac{4}{9} = \left(\frac{1}{9}+\frac{1}{9}+\frac{1}{9}+\frac{1}{9}+\frac{1}{9}+\frac{1}{9}+\frac{1}{9}\right) - \left(\frac{1}{9}+\frac{1}{9}+\frac{1}{9}+\frac{1}{9}\right)$

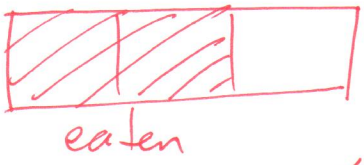
$= \frac{7-4}{9} = \boxed{\frac{3}{9}} = \boxed{\frac{1}{3}}$ subtract numerators.

Write a rule that can be used to solve for $\frac{a}{n}$ minus $\frac{b}{n}$. How does this compare to the rule for sums with like denominators?

$\frac{a}{n} - \frac{b}{n} = \frac{a-b}{n}$ if there is a common denominator. Subtraction is the opposite of addition (for the numerators)

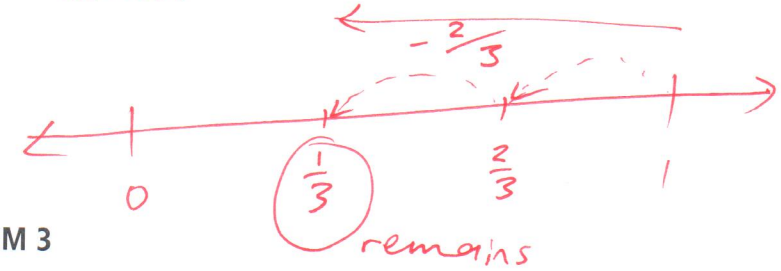
EXAMPLE 1

If you eat $\frac{2}{3}$ of a candy bar, how much of the candy bar is left? Draw an area model to show this. Can you also show this using a linear model?



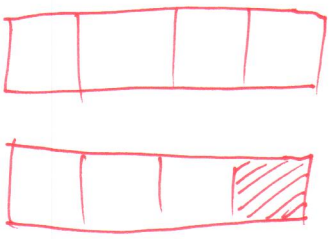
$\frac{1}{3}$ remains

$\frac{3}{3} - \frac{2}{3} = \frac{3-2}{3} = \frac{1}{3}$



PROBLEM 3

Compute the difference $2 - \frac{1}{4}$ and illustrate the process with either the area model or the linear model.



$1\frac{3}{4}$ remains (or $\frac{7}{4}$)

$\left(\frac{4}{4}+\frac{4}{4}\right) - \frac{1}{4}$

$\frac{8}{4} - \frac{1}{4}$

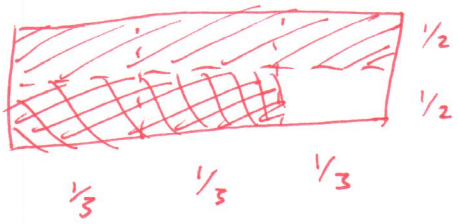
$\frac{8-1}{4} = \frac{7}{4}$

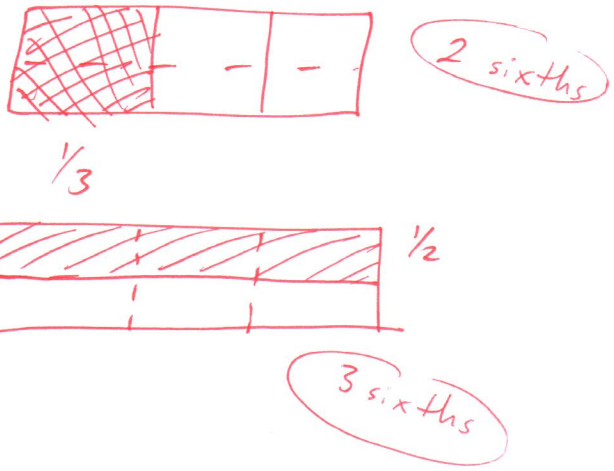
$= 1\frac{3}{4}$

EXAMPLE 2

Explore how to use the ideas just learned to compute the sum of two fractions when the denominators are not the same.

Use the area model to compute the sum $\frac{1}{2}+\frac{1}{3}$.





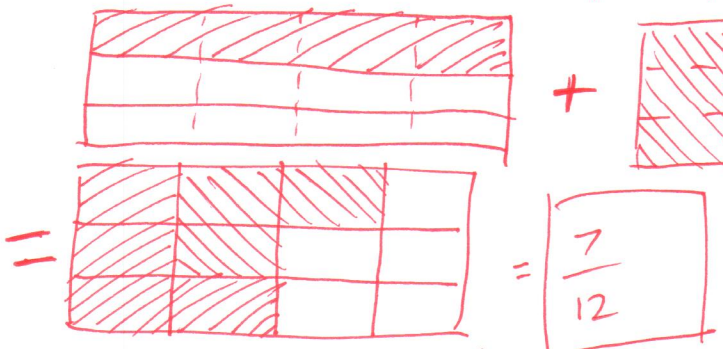
2 sixths + 3 sixths

= 5 sixths = $\frac{5}{6}$

EXPLORATION

Compute the sum $\frac{1}{3}+\frac{1}{4}$ by using the area model and then the equivalent fractions property to convert the initial fractions into equivalent fractions with like denominators.

$\frac{1}{3}=\frac{4\cdot1}{4\cdot3}=\frac{4}{12}$ $\quad$ $\frac{1}{4}=\frac{1\cdot3}{4\cdot3}=\frac{3}{12}$ $\quad$ $\frac{4}{12}+\frac{3}{12}=\frac{4+3}{12}=\frac{7}{12}$



$=\frac{7}{12}$

Find the pattern to add the fractions $\frac{1}{a}$ and $\frac{1}{b}$ when a and b are not the same number and explain the process. use the LCM of a and b as the LCD

OR $\frac{1\cdot b}{a\cdot b}+\frac{1\cdot a}{b\cdot a}=\frac{b+a}{a\cdot b}=\frac{1}{a}+\frac{1}{b}$

PROBLEM 4

Find three common denominators for the fractions $\frac{1}{6}$ and $\frac{1}{4}$. Write each fraction in equivalent forms using the three denominators. What do you notice about these common denominators? Which denominator would be the best choice for computing the sum $\frac{1}{6}+\frac{1}{4}$? Why?

12, 24, 36

All are common multiples of 6 and 4.

$\frac{1}{6}$	$\frac{1}{4}$
$\frac{2}{12}$	$\frac{3}{12}$
$\frac{4}{24}$	$\frac{6}{24}$
$\frac{6}{36}$	$\frac{9}{36}$

12 is nice because it is smaller, AND

$\frac{2}{12}+\frac{3}{12}=\frac{5}{12}$ is in simplest form.

PROBLEM 5

For each of the following sums:

(1) find a common multiple for both denominators

(2) use it to find equivalent fractions for each fraction

(3) compute their sum

(4) simplify your answer, if necessary.

a. $\frac{1}{9}+\frac{1}{12}$ 36

$\frac{4}{36}+\frac{3}{36}=\boxed{\frac{7}{36}}$

b. $\frac{1}{8}+\frac{1}{12}$ 48

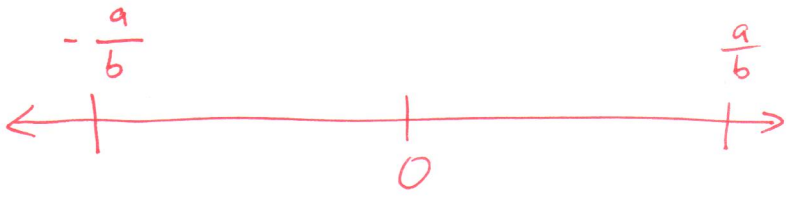
$\frac{6}{48}+\frac{4}{48}=\frac{10}{48}=\boxed{\frac{5}{24}}$

c. $\frac{1}{12}-\frac{1}{18}$ 36

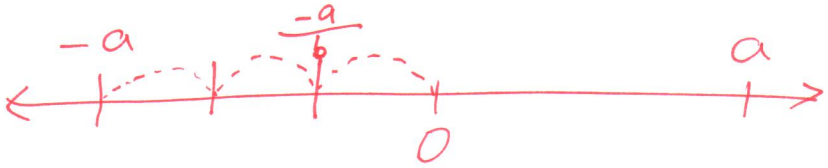
$\frac{3}{36}-\frac{2}{36}=\frac{3-2}{36}=\boxed{\frac{1}{36}}$

Why is $-\frac{a}{b}$ equivalent to $\frac{-a}{b}$?

Number line:



OR



PRACTICE EXERCISES

1. Add or subtract the following fractions.

a. $\frac{3}{7}+\frac{1}{7}$

$\frac{3+1}{7} = \boxed{\frac{4}{7}}$

b. $2-\frac{9}{14}$

$\frac{28}{14} - \frac{9}{14} = \frac{28-9}{14}$

$\boxed{\frac{19}{14}}$

c. $\frac{25}{36}+\frac{20}{36}$

$\frac{25+20}{36} = \frac{45}{36} = \boxed{\frac{5}{4}}$

$= 1\frac{9}{36} = \boxed{1\frac{1}{4}}$

d. $\frac{7}{x}+\frac{3}{x}$

$\frac{7+3}{x} = \boxed{\frac{10}{x}}$

e. $\frac{a}{m}-\frac{5}{m}$

$\boxed{\frac{a-5}{m}}$

f. $\frac{2x}{b}+\frac{3x}{b}$

$\frac{2x+3x}{b} = \boxed{\frac{5x}{b}}$

2. Add or subtract the following fractions. Write your answers in simplest form.

a. $\frac{1}{5}+\frac{1}{4}$

$\frac{4}{20}+\frac{5}{20}$

$\boxed{\frac{9}{20}}$

b. $\frac{1}{3}+\frac{1}{8}$

$\frac{8}{24}+\frac{3}{24} = \frac{8+3}{24}$

$\boxed{\frac{11}{24}}$

c. $\frac{1}{7}-\frac{1}{3}$

$\frac{3}{21}-\frac{7}{21}$

$\frac{3-7}{21}$

$\boxed{\frac{-4}{21}}$ or $\boxed{-\frac{4}{21}}$

d. $\frac{1}{9}-\frac{1}{6}$

$\frac{2}{18}-\frac{3}{18}$

(18 is the LCD)

$\frac{2-3}{18}$

$\boxed{\frac{-1}{18} \text{ or } -\frac{1}{18}}$

e. $\frac{1}{k}+\frac{1}{j}$

$\frac{j}{jk}+\frac{k}{jk}$

$\boxed{\frac{j+k}{jk}}$

f. $\frac{1}{2p}-\frac{1}{q}$

$\frac{q}{2pq}-\frac{2p}{2pq}$

$\boxed{\frac{q-2p}{2pq}}$

g. $\frac{1}{r}+\frac{1}{r^2}$

r^2 is the LCD

$\frac{1\cdot r}{r\cdot r}+\frac{1}{r^2}$

$\boxed{\frac{r+1}{r^2}}$

but if you forget

$\frac{r^2}{r\cdot r^2}+\frac{r}{r\cdot r^2}$

$= \frac{r^2+r}{r^3} = \frac{r(r+1)}{r^3}$

$= \boxed{\frac{r+1}{r^2}}$

SUMMARY (What I learned today)